



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Injury Models

Under-Body Blast (UBB) Models of Traumatic Brain Injury (TBI) Caused by Hyper-Acceleration and Secondary Head Impact

The vast majority of TBI suffered by Service Members is caused by blasts and these injuries are often inflicted upon occupants of vehicles targeted by improvised explosive device (IED). However, almost all of the animal research on blast TBI has concentrated on blast overpressure and has not taken into account the hyper-acceleration generated by UBB. With funding from the Psychological Health/TBI Research Program (PH/TBIRP) managed by the Congressionally Directed Medical Research Program (CDMRP), an interdisciplinary team of researchers at the University of Maryland Schools of Engineering and Medicine will use their previously developed rodent model of blast TBI caused by hyper-acceleration generated by UBB to elucidate the pathophysiology of TBI caused by UBB-induced hyper-acceleration. This model will be used to better understand the forces responsible for TBI caused by UBB and to mitigate these forces through modifications to vehicle hull designs. This knowledge will help guide the design of future military vehicles, with the goal of mitigating brain injury and other forms of trauma caused by UBB. To date, the study team has established the minimum UBB-induced gravitational force that produces TBI and the maximum that is survivable and is now combining this injury with a secondary head impact to better model the injuries experienced by Service Members in the field. The team is also testing possible mitigation techniques to reduce the energy transferred from the blast to the animal. One promising technique is a thin walled aluminum tube which is coated in polyurea. This device was found to reduce the gravitational force from the blast acceleration resulting in increased survivability and reduced injuries. This research will provide the first direct insight into the pathophysiology of mild TBI caused by hyper-acceleration generated by UBB and will establish the first animal model of TBI caused by this form of acceleration plus secondary head impact. This work taken together with tests of different vehicle hull designs on UBB-induced TBI will likely result in both engineering- and biomedical-based mitigations for TBI suffered by Service Members present within vehicles targeted by IEDs.

